



<b>Fermilab</b>		<b>Fermi National Accelerator Laboratory</b>	
Technical Division-Machine Shop			
<b>Welding Procedure Specification</b>		<b>No. Fermi WPS Ti-2</b>	<b>Date 11/21/2008</b>
Revision: 1	Date: 1/0/2008	Remarks: Revised to correct clerical errors	Supporting PQR No.(s) Fermi PQR Ti-1
Welding Processes	(1) GTAW	Type 1	(Manual, Auto, Semi) Manual
Welding Processes	(2)	Type 2	(Manual, Auto, Semi)

<b>Joints (QW-402)</b>			
Joint Design	Single "V" Groove		
Backing Material (Type) Root	Gas		
Retainer	None	Type	
Backing	Open Root Gas Backing		
Remainder	Deposited Metal		
Non-Metallic	Metallic(non-fusing)		
0.109 wall x 1.50 OD Tube welded in Atmospheric Chamber 99.995% Argon Gas			

<b>Base Metals (QW -403)</b>			
P No. 51	Group No.	TO	P No. 51
Specification Type & Grade	SB 861 Grade 2	TO	Specification Type & Grade
or Chemical Analysis & Mechanical Properties	N/A		
to Chemical Analysis & Mechanical Properties	N/A		
<b>Thickness Range</b>		<b>Process</b>	
Base Metal	Groove 0.0625-0.218	Fillet	Unlimited
Deposited Weld Metal	Groove 0.109 Max	Fillet	Unlimited
Pipe Diameter Range	Groove 1" Min-Unlimited	Fillet	Unlimited
<b>Other:</b>			

<b>Filler Metals (QW-404)</b>	<b>Process 1</b>	<b>Process 2</b>
Specification No. (SFA)	5.16	N/A
AWS No. (Class)	ERTi-2	N/A
F-No.	51	N/A
A No.	ERTi-2	N/A
Size of Filler Metals	1/16 & 3/32 diameter	N/A
Deposited Weld Metal Thickness Range	0.0625-0.294	N/A
Electrode-Flux (Class)	N/A	N/A
Flux Trade Name	N/A	N/A
Consumable Insert	N/A	N/A

Each Base Metal-Filler Metal combination should be recorded individually



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Positions (QW-405)			Post-weld Heat Treatment (QW-407)	
Positions of Groove	1GR		Temperature Range	None
Welding Progression	Rotated		Time Range	N/A
Positions of Fillet	N/A		Other	

Preheat (QW-408)		Gas (QW-408)		
Preheat Temperature	32°F	Percent Composition		
Interpass Temperature	350° F	Gas	Mixture	Flow Rate
Preheat Maintenance	N/A	Shielding	>99.99% Argon in Chamber @ 40 CFH	
Minimum Temperature for Welding	32°F	Trailing	None	
		Backing	>99.99% Argon in Chamber @ 40 CFH	

Electrical Characteristic (QW-409)				
Current AC or DC	Direct Current	Polarity	Straight	Characteristics: Non-Pulsing
AMPS (Range)	See Chart	Volts (Range)	See Chart	
Tungsten Electrode Size & Type:		3/32 diameter EWCe-2		
Mode of Metal Transfer for GMAW:		N/A		
Electrode Wire Feed Speed Range:		N/A		

Technique (QW-410)	
String or Weave Bead	String or weave. Weave not to exceed 1/8" wide
Orifice or Gas Cup Size	#4 Gas Lens
Initial/Interpass Cleaning (Brushing, Grinding, ect.)	Initial cleaning with alcohol solvent Break surface oxides with Carbide Burr (Optional)
Method of Back Gouging	None
Oscillation	N/A
Contact Tube to Work Distance	N/A
Multiple or Single Pass (per side)	Multi-pass
Multiple or Single Electrodes	Single
Travel Speed (Range)	As Required
Peening	None
Other	Weld in inert weld chamber purged with >99.99% Ultra Pure Argon @10 PPM

Weld Layers	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Other (Power Source)
		Class	Dia.	Type Polarity	Amp Range			
1	GTAW	ERTi-2	1/16	DCEN	65-85	6-10	As Req.	
2-Final	GTAW	ERTi-2	3/32	DCEN	75-95	8-14	As Req.	